

1           What is claimed is:

2       Sub  
3       A1

- 1           1. A method of electronic watermarking comprising:  
2                   sampling input signals using an uneven sampling rate.
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- 1           2. The method according to claim 1, wherein the sampling  
2                   comprises sampling at a rate such that an average sampling frequency is  
3                   greater than or equal to twice the highest frequency in the input signals.
- 4
- 1           3. The method according to claim 1, wherein the sampling  
2                   comprises sampling using a pseudo-random sampling rate.
- 3
- 1           4. The method according to claim 1, wherein the sampling rate  
2                   has an unevenness which is pseudo-random and the unevenness is less  
3                   than about thirty per cent of the corresponding sampling period.
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- 1           5. The method according to claim 1, wherein the input signals  
2                   are analog input signals, the method further comprising:  
3                           outputting unevenly sampled digital signals.
- 4
- 1           6. A method of authentication of candidate data comprising:  
2                   sampling original signals using an uneven sampling rate to produce  
3                   unevenly sampled original signal data; and  
4                           comparing the unevenly sampled original signal data with the  
5                   candidate data for a degree of match.
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- 1           7. The method according to claim 6, further comprising:  
2                   normalizing the candidate data prior to the comparing; and  
3                           normalizing the unevenly sampled original signal data prior  
4                   to the comparing.
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1        8.     The method according to claim 7, wherein the comparing  
2 comprises calculating a mean square difference between the normalized  
3 candidate data and the normalized unevenly sampled original signal data.

A/ 1        9.     The method according to claim 8, further comprising  
2 comparing the calculated mean square difference to a threshold value,  
3 wherein if the calculated mean square difference is greater than the  
4 threshold value, the candidate data is determined to be inauthentic.

5        10.   A method of detecting if a suspect signal has been sampled  
6 using an uneven sampling rate, wherein the signal includes at least one  
7 monotonic sine wave, comprising:

8              performing a frequency analysis of the suspect signal; and  
9              detecting the presence of a phantom frequency indicating that the  
10          monotonic sine wave was sampled using an uneven sampling rate.

A/ 1        11.   An apparatus for electronic watermarking, comprising:  
2              input means for receiving input signals; and  
3              sampling means for sampling the input signals using an  
4          uneven sampling rate.

1        12.   The apparatus according to claim 11, wherein the sampling  
2 means comprises:  
3              an analog-to-digital converter; and  
4              control means for controlling the analog-to-digital converter  
5          to have an uneven sampling rate.

6        13.   The apparatus according to claim 12, wherein the control  
1          means comprises a pseudo-random number generator.  
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1        14. The apparatus according to claim 12, wherein the control  
2 means controls the analog-to-digital converter to sample the input signals  
3 at a rate such that an average sampling frequency is greater than or equal  
4 to twice the highest frequency in the input signals.

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1        15. The apparatus according to claim 14, wherein the sampling  
2 rate has an unevenness which is pseudo-random and the unevenness is  
3 less than about thirty per cent of the corresponding sampling period.

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1        16. An apparatus for authentication of candidate data  
2 comprising:

3              sampling means for sampling original signals using an uneven  
4 sampling rate to produce unevenly sampled original signal data; and  
5              comparing means for comparing the unevenly sampled original  
6 signal data with the candidate data for a degree of match.

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1        17. The apparatus according to claim 16, further comprising:  
2              first normalizing means for normalizing the candidate data and  
3 providing normalized candidate data to the comparing means; and  
4              second normalizing means for normalizing the unevenly sampled  
5 original signal data and providing normalized unevenly sampled original  
6 signal data to the comparing means.

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1        18. The apparatus according to claim 17, wherein the comparing  
2 means comprises mean square difference calculating means for  
3 calculating a mean square difference between the normalized candidate  
4 data and the normalized unevenly sampled original signal data

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1        19. The apparatus according to claim 18, wherein the comparing  
2 means further comprises threshold means for comparing the calculated  
3 mean square difference to a threshold value, wherein if the calculated

A1 4 mean square difference is greater than the threshold value, the candidate  
5 data is determined to be inauthentic

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1 20. A method for generating an unevenly sampled signal  
2 comprising:

3 sampling a waveform to produce evenly spaced samples; and  
4 adding to the even spaced samples an uneven sampling pattern.

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1 21. The method according to claim 20, further comprising  
2 reusing the uneven sampling pattern so that it repeats after the last value.

3

1 22. A method of producing an evenly sampled sequence from  
2 an unevenly sampled sequence, comprising:

3 interpolating the unevenly sampled sequence by resampling at a  
4 rate higher than a sampling rate used to produce the unevenly sampled  
5 sequence, thereby producing a resampled sequence; and

6 decimating the resampled sequence at a even sampling rate  
7 thereby producing an evenly sampled sequence.

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1 23. A method of detecting whether a suspect signal is an original  
2 signal which has been sampled unevenly, comprising:

3 providing an evenly sampled original signal;

4 comparing the evenly sampled original signal to the suspect signal  
5 by determining an absolute value of a difference between the amplitudes  
6 of the evenly sampled original signal and the suspect signal for a given  
7 sample index.

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1 24. A data processing system comprising:

2 means for implementing a data watermarking processing;  
3 and

A | 4 means for implementing a data watermark authentication  
5 processing.  
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